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# Tech Tips

United States Department of Agriculture  
Forest Service



Technology &  
Development Program

July 1993

5700

9357 1304-SDTDC

## Helicopter Operations and External Accessories: An Update

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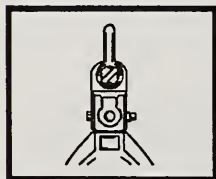
### FAILED SAFETY GATES



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## FAILED SAFETY GATES

A review of incident reports by San Dimas Technology and Development Center verified field reports of a recurring problem with helicopter leadline hooks. Eighteen per cent of all inadvertent load releases were attributed to gate failures on either swivel or leadline hooks. Such a failure is shown in figure 1.



*Figure 1. Swivel hook with bent gate.*

These failures represent a significant safety hazard and loss of equipment. All personnel working with hooks should be made aware of this situation. This Tech Tip will alert you to the problem, provide standards to use when inspecting hooks, and propose a low cost alternative to repair damaged gates.

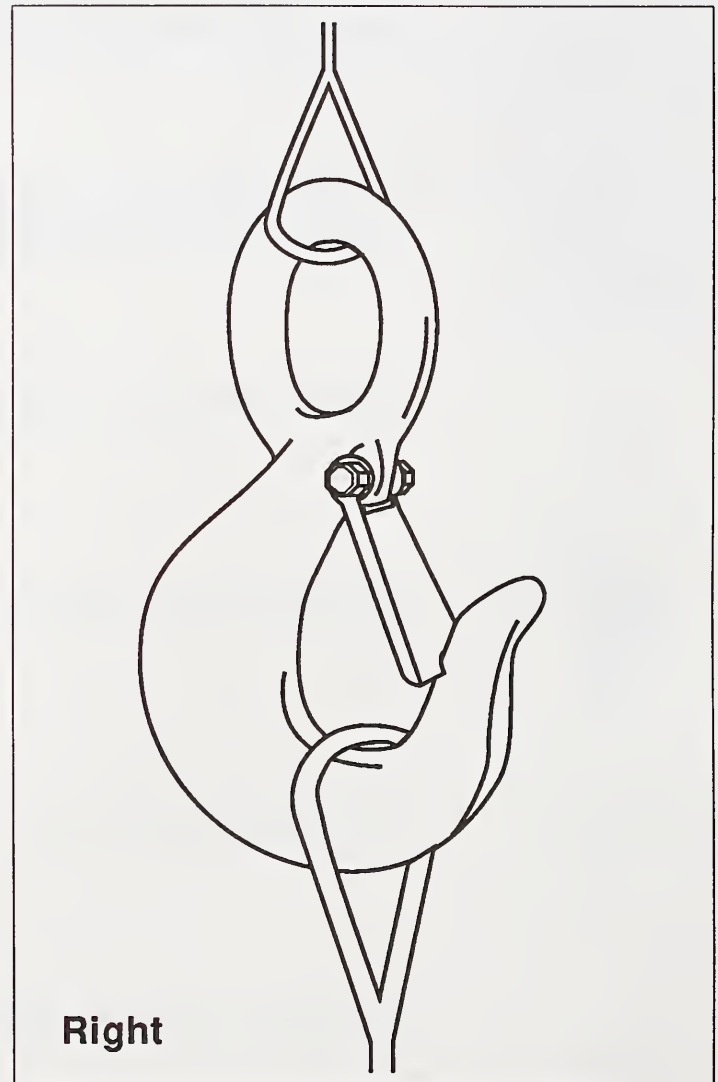
Safety gates (keepers or latches) that have become bent or distorted no longer help protect a sling load from inadvertently coming off the hook. Usually the latch is bent or distorted by dropping the hook with a ring in it, or by allowing the load to apply a side force to the latch. In any case, the result is a damaged unacceptable latch. The solution is to replace the damaged latch.

One original equipment hook manufacturer, Crosby Group, Tulsa, OK, quoted the cost of the replacement parts at \$2.05 for a two-ton plain carbon hook.

The replacement kit nomenclature is "SS-4055 x ton" where x is the hook rating in tons. It includes a new gate, spring, bolt and self-locking nut (all stainless steel) and may be purchased from any Crosby distributor.

Loads may disengage from hook if proper procedures are not followed. Hook manufacturers recommend the following:

- Always inspect hook and latch before using.
- Never use a hook with latch that is distorted or bent.
- Always make sure the spring will force the latch against the tip of the hook.
- Always make sure the hook supports the load (see figure 2).



*Figure 2.*



- \* The latch must never support the load (see figure 3)

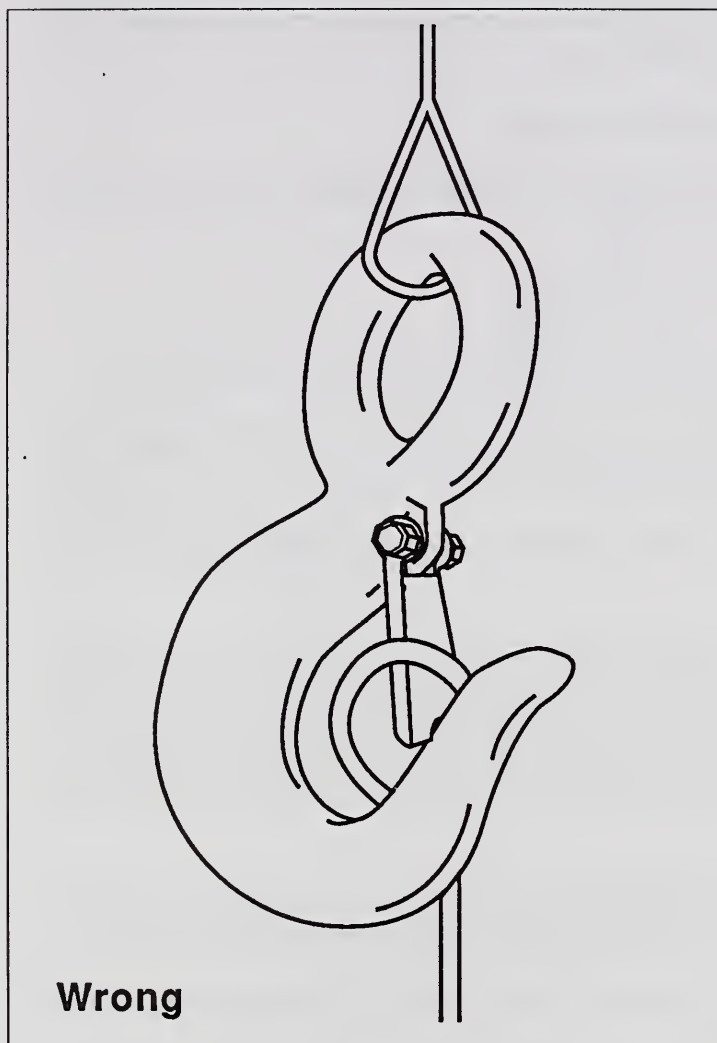


Figure 3

- When placing two rings in a hook, make sure the angle from the vertical to the outermost ring is no greater than 45 degrees and the included angle between the rings does not exceed 90 degrees (see figure 4).
- Latches are intended to retain loose leadlines or devices under slack conditions. Latches are not intended to be anti-fouling devices.

Some aftermarket suppliers can provide replacement latches. Criteria for selecting an aftermarket replacement latch are: 1) it must be as stout as the original, 2) it must be the same overall length, 3) the latch pivot point must be in the same location and the same diameter, and 4) it must work freely when installed.

Latches capable of bearing a load are not available from any source for this style of hook; therefore, we

suggest that the latches should be: 1) inspected daily when in use, 2) inspected for damage every time they are checked into or out of a cache, and 3) replaced if bent or distorted.

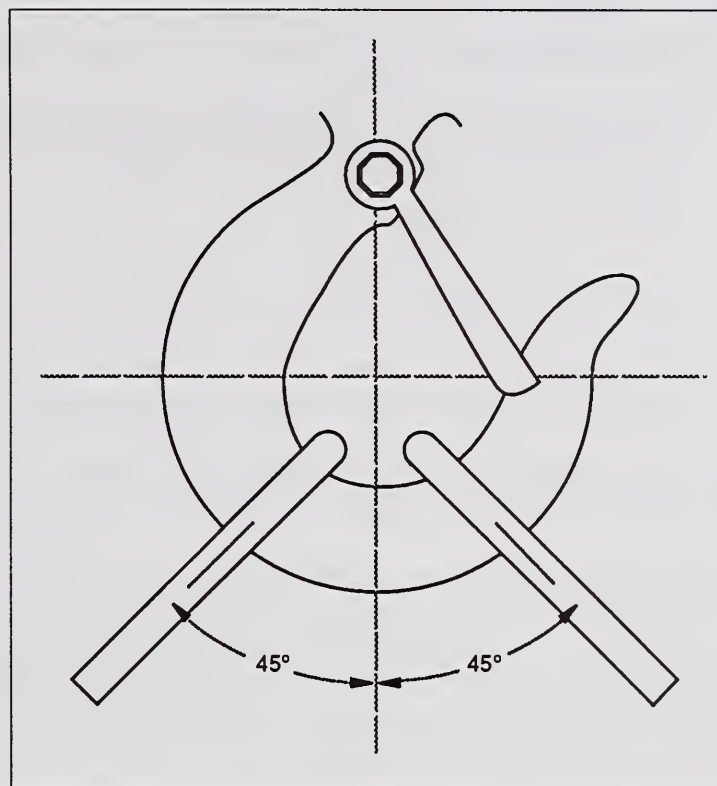


Figure 4

## CORRECT ATTACHMENT HARDWARE FOR USE WITH LIGHT CARGO NETS

A carabiner, shackle, clevis, or similar locking hardware should be used to gather and attach the corner loops or drawstring rope when using a lightweight cargo net without thimbles to reduce the chances of dropping and to prevent uneven loop wear. This hardware is then connected to the hook of a cargo swivel. Some Helicopter Operations Specialists have also found that placing a cinch knot in the ends of the drawstring loops and attaching to the swivel is helpful in reducing the chances of the loops slipping past the swivel hook latch.

## UPDATE ON SEI INDUSTRIES' SACKSAFOAM FOAM INJECTION SYSTEM

In response to a field survey, the following comments were received by the Center regarding the SEI Industries Ltd., "Sacksafoam" foam injection system (see figure 7). Respondents in general liked the system and felt it worked well, but noted improvement was needed in the following areas:

- Refilling the concentrate reservoir was messy and required two people.
- Filling the bucket with a partially empty Sacksafoam was difficult. The bucket had a tendency to float unless the foam reservoir was nearly full.
- One control box burned out.
- The pump gummed up if not cleaned thoroughly (a problem found with other foam systems as well).
- The bucket was too heavy for single-person loading into the helicopter. One crew member sustained a back injury when attempting to load a bucket with the foam system in it.

The bucket must be carried vertically or the bladder will leak. Where larger concentrate reservoirs are used, SEI suggests carrying a minimum amount of liquid.

SEI has made changes to the seals, the control unit, introduced a fill pump and a special hose for emptying (see figure 5). They now supply oversized storage bags which hold both a Bambi Bucket and the Sacksafoam. According to their literature, the new fill pump eliminates spillage; is portable and lightweight; has brass self-sealing inlet and outlet connectors on the reservoir; and comes in its own carrying case complete with spare fuses and operating instructions. It is designed to deliver eight gallons per minute; be quickly installed and removed; and operate on 24 volts dc.

Flanges are now silicon sealed to prevent foam concentrate seepage and fittings are coated with Teflon. Control units, built to aviation standards which mount flush in the panel, are now available (see figure 6).

For additional information contact: SEI Industries Ltd., 7400 Wilson Avenue, Delta, BC Canada V4G 1E5, Phone: (604) 946-3131, FAX: (604) 940-9566.

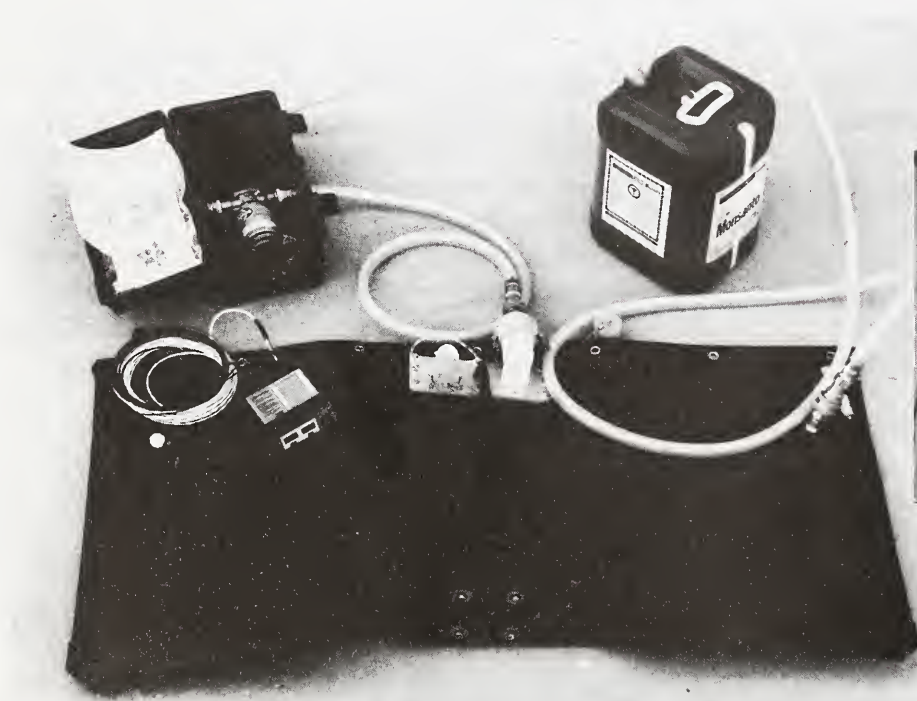


Figure 5. New Sacksafoam Reservoir "Quik-Fill" Pump System.



Figure 6. New rail mount controller.



ITEM	DESCRIPTION	PART No.
1	Sacksafoam Control Box	SFF-001
2	Control Box Wiring Harness (includes breakaway connector)	SF-515
3	Breakaway Plug	ECON-025
4	Breakaway Receptacle	ECON-026

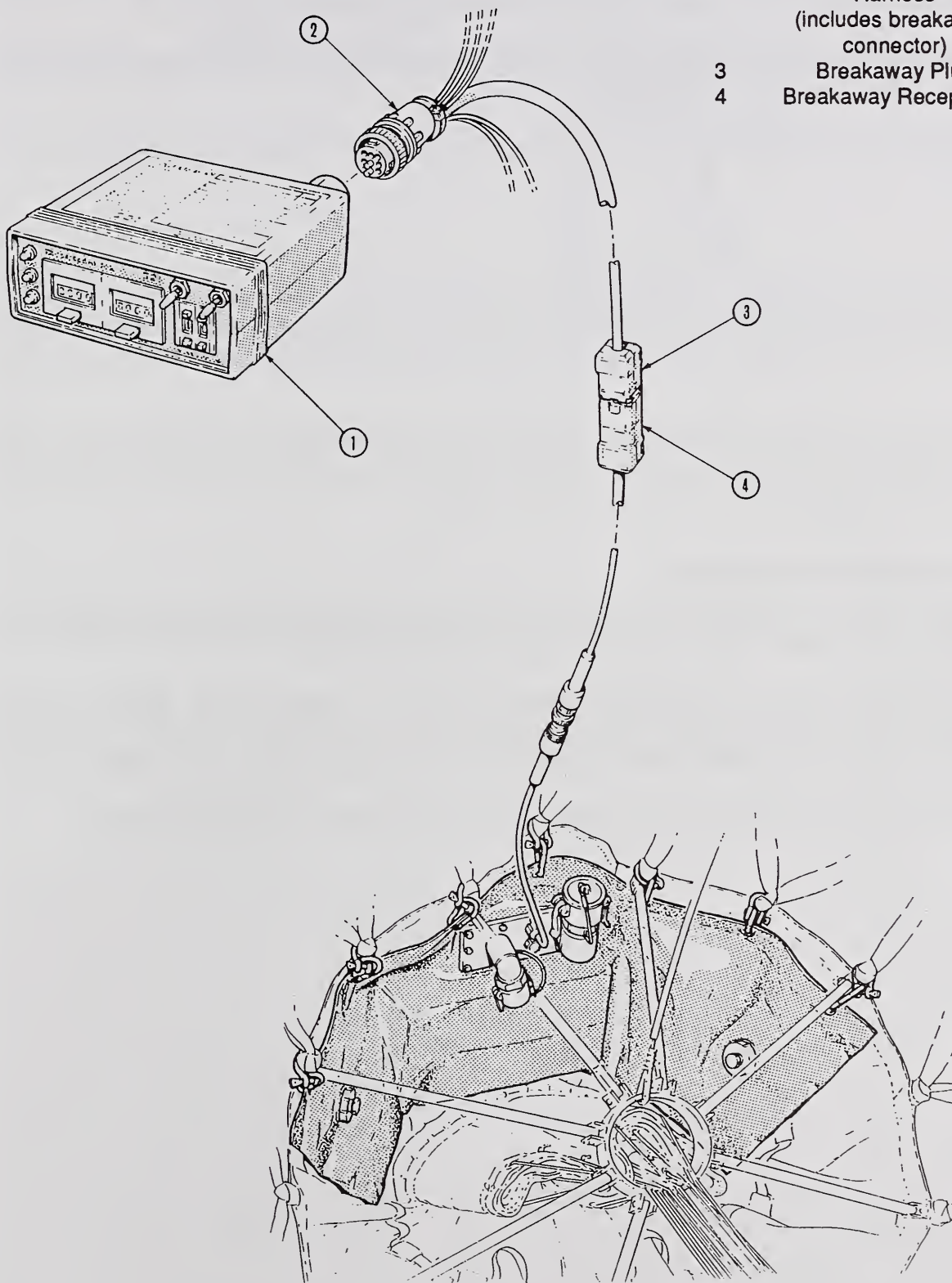


Figure 7. Sacksafoam System.

# **BAMBI BUCKET CONTROL HEAD FAILURE**

## **Background**

During the 1992 fire season, a control head in use on a Model 2024 Bambi Bucket fractured causing the bucket to be damaged beyond repair after falling 15 feet into open water. The location of the casting failure is shown in figure 8. At the time of the incident, a Bell Model UH-1B helicopter was carrying the load.

This is the first known failure with any Bambi Bucket. After learning of this failure, another control head, bent in the same location, was found during a field inspection.

Many agencies were concerned and this Center was asked to investigate the mechanical aspects of the incident.

## **Findings**

The failed part was subjected to a static proof tension test of 20,200 pounds, applied in the vertical direction, during manufacture. That load exceeds the required factor of safety by a wide margin and should never be reached during normal use. SEI Industries Ltd., examined the head and found neither casting flaws nor progressive cracks.

Deformation to the control head showed that substantial front and side force had been applied to the lug. The circumstances leading to this unusual loading remain unknown. Severe shackle and yoke wear were also observed, indicating that the system had been in use for some time.

## **Conclusions and Recommendations**

We concur with the manufacturer's findings that the failure was due to excessive bending force, not design or fabrication shortcomings. The cause of this excessive force remains unknown.

The U. S. Department of Interior, Office of Aircraft Services issued a Safety Alert Bulletin dated September 1992 recommending visual inspection of all control heads in the field. Evidence of cracks, surface scars, elongation, bending or any misalignment is cause for removal of the control head from service.

Incidents such as this reinforce the importance of not flying over people, traffic, or congested areas.



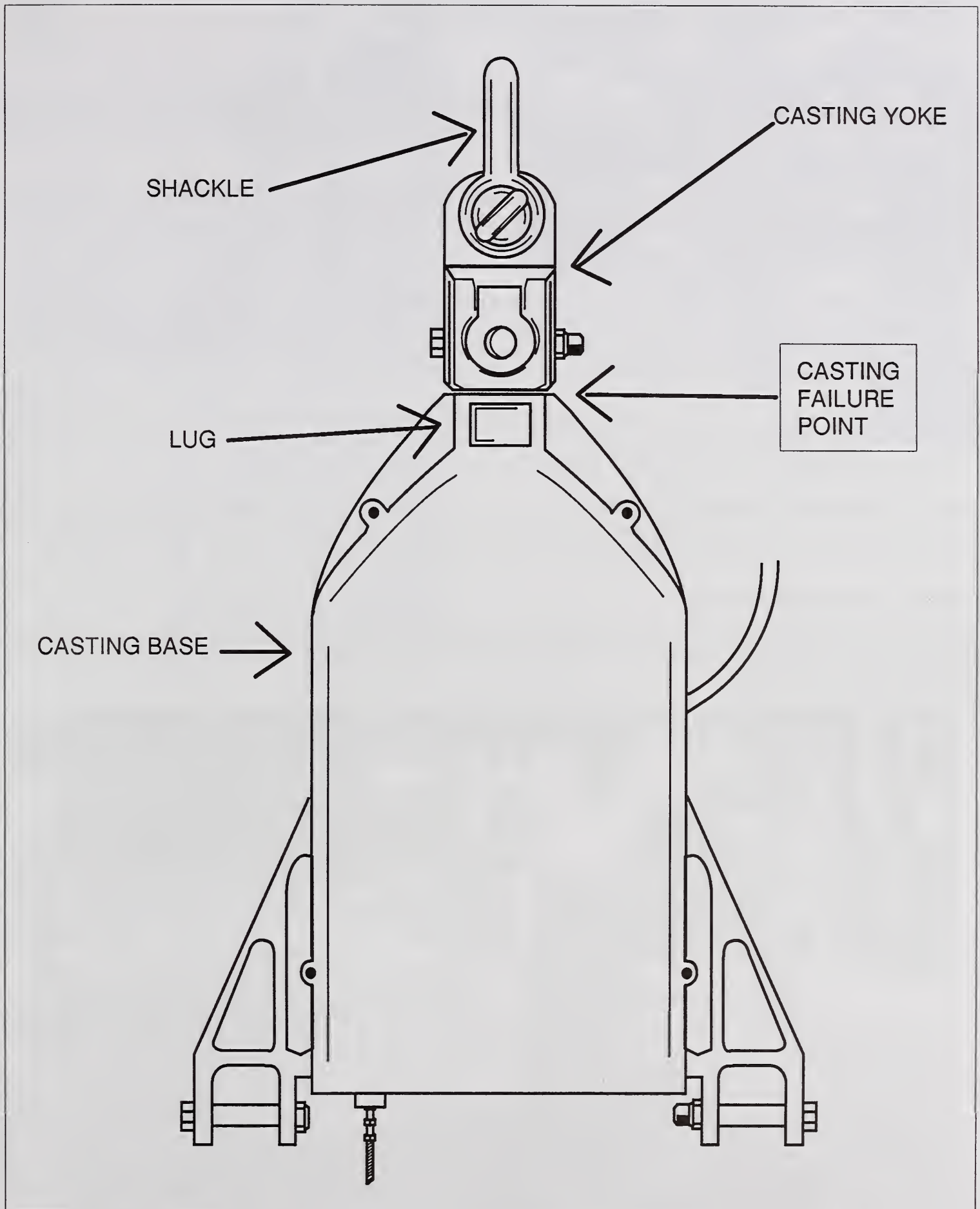


Figure 8. SEI Bambi Bucket control head, Model 2024.

## RETRIEVABLE NET SYSTEM — FLYAWAY NETS

### Background

After large fires, helicopters are often used to transport bales of straw into remote sections of burned over lands where no other means of delivery are practical. These projects sometimes involve the distribution of hundreds of bales of straw.

Bales are usually placed in a net and slung under the helicopter for transport to where they are needed. Flyaway nets allow helitack crews to use fewer nets and eliminate the need to pack them out.

### Description of System

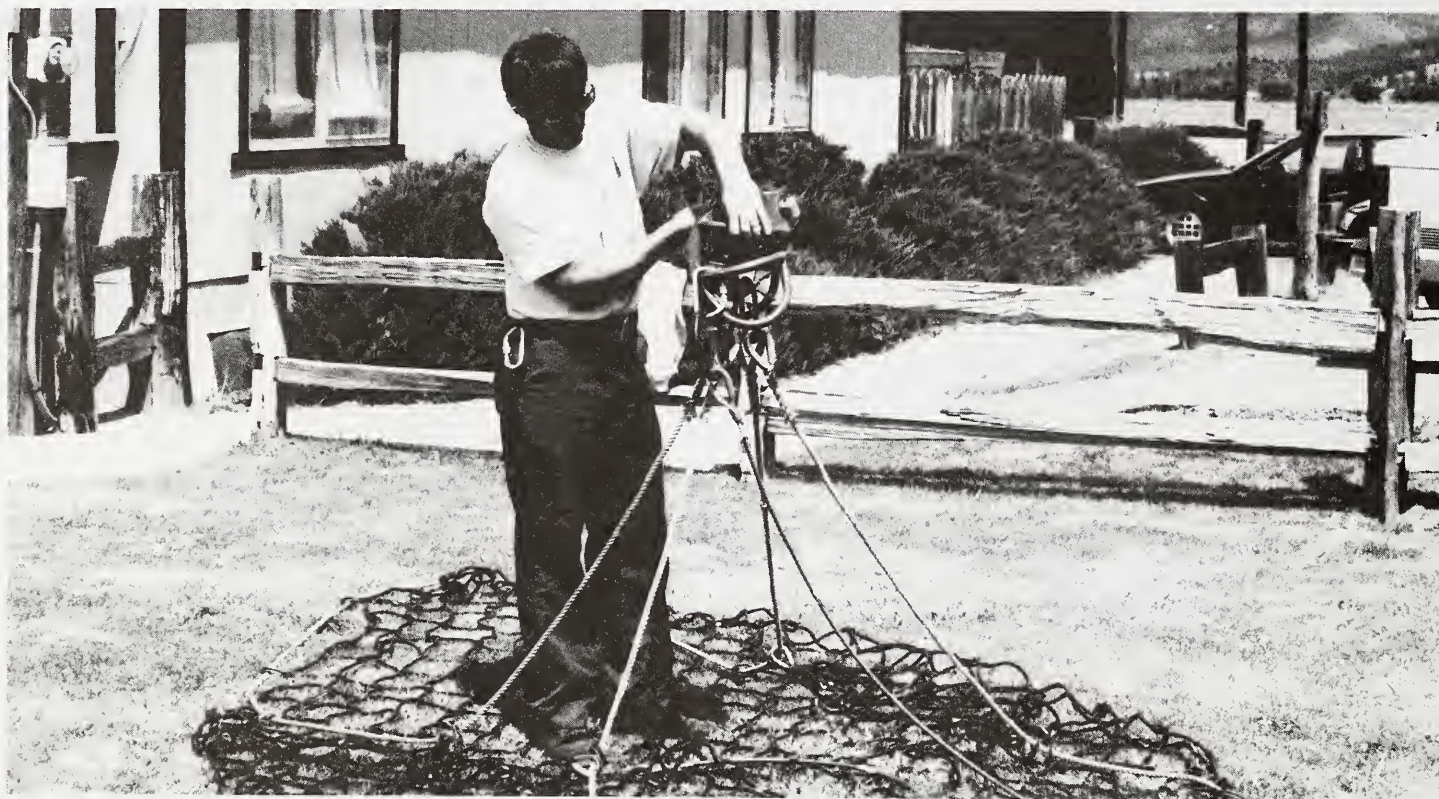
Either a drawstring or four-corner pickup ("trash") net can be used. Figure 9 shows the technique used with a drawstring net. One end of the drawstring is permanently attached to the remote hook cage, the other is looped through the remote hook. When the hook is opened, cargo is released and the net remains attached to the cage. The net returns to the loading site and is reloaded or removed.

Figures 10 and 11 show the technique being used with four-corner nets. One corner is attached to the cage using a steel locking "D" carabiner and the remaining corners are looped over the hook. When the hook is opened, cargo falls and the net remains attached to the cage.

Figure 12 shows the net thimbles in the remote hook with the ring of a 15-foot leadline permanently attached to the remote cage. The hook on the leadline is attached to the center of the drawstring net. When the hook is opened, cargo falls, and the leadline and net remain attached to the cage.

### Safety Considerations

Helicopter air speed must be slow enough that the longline and net are not swept back toward the tail rotor. Personnel report that bales occasionally get hung up when using drawstring nets. This has not been observed with four-corner pickup nets.



*Figure 9. Assembly view of drawstring type net.*





Figure 10. Assembly view of four-corner net.



Figure 12. Rings in remote hook, leadline in carabiner with drawstring net.



Figure 11. One corner of four-corner net attached to remote hook cage.



## CARGO LIFT BAGS

### Background

Cargo lift bags, also known as "flexible intermediate bulk containers," are an inexpensive alternative to cargo nets for helicopter sling work. Personnel in Alaska Region (Region 10) have been using these plastic bags for more than five years. Pacific Northwest Region (Region 6) started using the bags during the 1992 fire season.

### Features

Bulk lift bags are available in a range of standard and custom made sizes; cubic in shape; and made from an ultraviolet resistant polypropylene fabric that "breathes." Most styles have a safety band around the perimeter of the bag. Options include different liners, lifting straps, filling and emptying options. Messages can easily be printed on the bags by several methods.

The bag that has been used in Regions 6 and 10 weighs about 5 pounds; is rectangular (35 by 35 by 40 inches); and has a 5:1 safety factor when loaded to 3000 pounds according to the manufacturer. Options include heavier weight fabric, a bottom chute (see figure 13) and tie string (see figure 14). Region 10 attaches the four-corner loops into a swivel hook and uses a longline between the swivel and the helicopter belly hook.

### Safety Considerations

These bags should not be flown empty to eliminate any chance for tail rotor entanglement. Region 6 has required a stenciled warning on all bags, that 50 pounds or more be in the bags during any flight and airspeed be reduced.

### Availability

The cost per bag is about twenty-five dollars. At this time other sources of supply have not been located. For additional information contact:

Bulk Lift International, 231 West Main Street, Carpentersville, IL 60110, Phone: (1-800) 879-2247, FAX: (708) 428-7180.

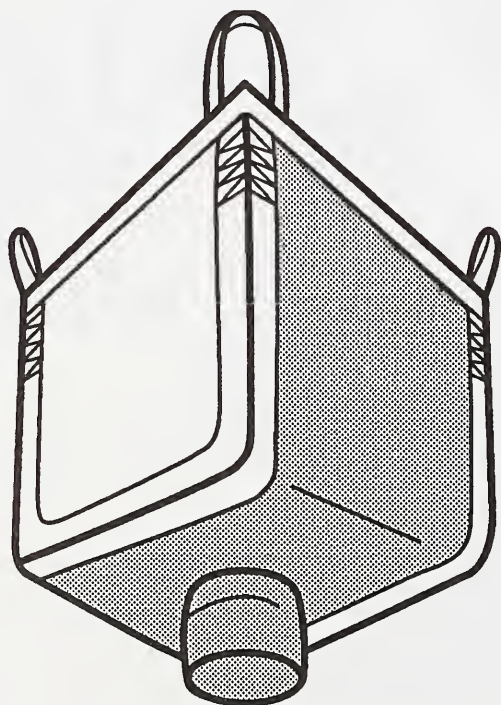


Figure 13. Bulk lift bag with 14- by 18-inch outlet.

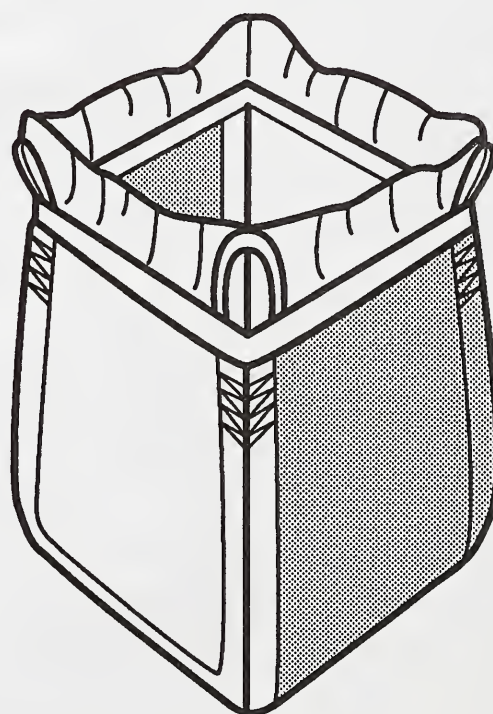


Figure 14. Bulk lift bag with Duffle Top.

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2. A large collection of FAA Advisory Circulars
3. A collection of flight manuals for various helicopters and airplanes
4. Aircraft Type Certificate Data Sheets
5. A large collection of files containing engineering studies, test reports, test data, and general information dating back to the origin of airtankers.

The library includes the following categories:

- a. Helicopters
- b. Airtankers
- c. General Aviation/fixed wing
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- e. Forest Service STC's

An index of AIR materials is available upon request. Copies of AIR materials can then be requested.

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San Dimas, CA 91773  
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